Application Serial Number 10/038,547 RCE Filed 1/12/2006
Examiner Camquy Truong, Group Art Unit 2195 Attorney Docket Number RA-5368

Remarks

This Request for Continuing Examination (RCE) is accompanied by the amendment set forth above. This RCE is filed following receipt of an Office Action dated 9/12/2005 which was made FINAL ("Final Rejection"). In that Final Rejection, Claims 5-10 and 12-26 were rejected. In the amendment set forth above, Claims 5, 6, 8-10, 12, 15-26 are amended, and the remaining Claims are unchanged. In view of these amendments to the Claims, and the arguments set forth below, it is respectfully submitted that Claims 5-10 and 12-26 are allowable over the art cited in the Final Rejection, and are in condition for allowance.

1. In the Final Rejection, Claims 5-10 and 18 were rejected under 35 USC §112 second paragraph as being indefinite for failing to particularly point out and distinctly claim the subject matter of the invention. In particular:

A. In reference to Claim 5, it was said that the phrase "a transfer program for transferring control of said next available IP resource from said second stage lottery program..." was not clearly understood. This phrase has been replaced with " a transfer program for assigning said next available IP resource to execute a task assigned to said selected one of said at least two levels..." This language thereby clarifies that the transfer program is causing the IP resource to execute a task that is assigned to the selected level. This corresponds to the description in Applicants' Specification. (Applicants' Specification page 12 lines 12-14.) With this change, it is believed that Claim 5 satisfies the requirements of 35 USC §112, and this rejection should be withdrawn. The objection to dependent Claims 6-7 and 9-10 that depend from Claim 5 should likewise be withdrawn.

B. In reference to Claim 8, it was said that the phrase "each level of said at least two levels will only have tasks of like quantum values within said

each level" is not clearly understood. This phrase has been replaced with "wherein tasks within each level of said at least two levels will be assigned to said next available IP resource for a same amount of time as other tasks in said level". This makes clear that according to this embodiment of the invention, each task in the level is assigned an available IP resource for the same amount of time. With this change, it is believed that Claim 8 satisfies the requirements of 35 USC §112, and this rejection should be withdrawn.

C. In reference to Claim 18, it was said that the phrase "a transfer program for transferring control from said second stage lottery program to a task found" is not clear. This phrase has been changed to "a transfer program for causing said IP resource to begin execution of a task assigned to said selected one of said at least two levels". This more clearly articulates the purpose of the transfer program. This is similar to the amendment set forth herein for Claim 5 above, and is in accordance with the description in the Specification. (See Applicants' Specification page 12 lines 12-14.) With this change, it is believed that Claim 18 satisfies the requirements of 35 USC §112, and this rejection should be withdrawn.

With the above-described amendments to the Claims, it is believed that all pending Claims now satisfy the requirements of 35 USC §112, second paragraph, and this rejection should be withdrawn.

2. Claims 5-10 and 12-26 were rejected under 35 USC §103(a) as being unpatentable over the paper entitled "Time-Function Scheduling: A General Approach to Controllable Resource Management" by Liana L. Fong et al. ("Fong") in view of U.S. Patent No. 5,569,084 to Nicastro et al. ("Nicastro"). This rejection is respectfully traversed.

Each of Applicants' independent claims describes a *two-stage lottery mechanism* as follows:

1. A first lottery stage is conducted to select a class of tasks.
2. A second lottery stage is conducted to select one of multiple levels contained in the selected class.
3. A pending task is selected from the selected level. (Applicants' Specification page 8 line 24 through page 9 line 11.)

This two-stage lottery can be completed very efficiently, and applies the benefits of the random selection process both to the class selection, and the level selection. Moreover, the use of multiple levels within the class makes the system flexible, and provides for a large number of scheduling options.

The Examiner states that this two-stage lottery process is taught by Fong. Fong mentions several methods of resource allocation. According to one method, a lottery method is used to select a job class. Then a first-come-first-service (FCFS) algorithm (NOT a lottery mechanism) is used to select the job, as follows:

> "Our prototype therefore implements a slightly modied (sic) version of lottery scheduling in which tickets are assigned to job classes instead of individual jobs. **The resource is then granted to the job at the head of the run-queue associated with the class holding the winning ticket. An FCFS ordering is maintained at each run-queue."** (Fong page 13 section 3.2, lines 6-9, emphasis added.)

Thus, this Fong method implements a ***one-stage lottery mechanism*** that selects a class via a lottery, and then selects the job at the head of the run queue for the selected class.

Fong also describes another alternative process that uses a Time Function Scheduling (TFS) mechanism (NOT a lottery mechanism) to select a class, while using a lottery scheme to determine which task within the class will

be executed, as follows:

> "One possible approach of combining both scheduling mechanisms would be to use TFS to control resource allocation across classes while using a lottery scheme to determine which task which the class (or which thread within an application) gets dispatched." . (Fong, sentence bridging pages 21 and 22.)

From the foregoing, and from further analysis of Fong, the following may be observed:

1. Nothing in Fong describes use of multiple levels within classes.
2. Nothing in Fong describes using a lottery to select a level from a class.
3. Nothing in Fong describes selecting a task from a selected level.
4. Nothing in Fong describes a two-stage lottery that uses a first stage to select a class, and a second stage to select a level.

For at least the foregoing reasons, Fong does not teach, or even suggest, the elements of Applicants' independent Claims.

Next, Nicastro is considered. This reference describes a mechanism of controlling the odds for any given symbol set (e.g., three bars) of a reel-type slot machine. According to this method, all of the possible reel stop combinations are assigned to unique terminal (child) nodes in one or more hierarchical tree structures. The odds of obtaining a symbol set are controlled by selecting which of the levels of hierarchy in the tree structure will contain this symbol set. This is described in reference to Figure 5 (Nicastro column 3 line 66 – column 4 line 3.)

During a "spin" of the slot machine wheel, a symbol set is selected from a tree as follows. Starting at the root node of the tree structure, a random number generator is used to select a child node of the root node. If this child node is not a terminal node, this child node is made the current node, and another random number is generated to select a child node of this current node. This process is

repeated until a terminal (leaf) node of the tree is encountered. The terminal node is associated with the reel stop combinations.

Several observations may be made about Nicastro.

1. Contrary to the Examiner's assertions, Nicastro does not teach, or even suggest, selecting a priority level from a selected class, and then selecting a task from that priority level. In fact, Nicastro has nothing to do with selecting a task, as described further in reference to the following point.

2. Nicastro is a program for use with slot machines, and has nothing whatsoever to do with resource allocation. One skilled in the art would not be motivated to combine aspects of the Nicastro slot machine mechanism with any Fong resource allocation process.

3. One skilled in the art would not be motivated to combine any aspect of Nicastro with Fong for at least one additional reason: Fong *teaches away* from the use of *any* lottery mechanism (*much less a two-stage mechanism*) in favor of the Time Function Scheduling (TFS) resource allocation approach which does not use a lottery. This is discussed in Fong as follows:

> "Our experimental results demonstrate that TFS achieves the same proportional execution rate goals [as lottery scheduling] *while significantly reducing the waiting time variance, in some cases by as much as several orders of magnitude*." (Fong page 5, second sentence of first full paragraph, in reference to a discussion of lottery scheduling that immediately precedes this passage.)

This is reiterated by Fong as follows:

> "In particular, we show that TFS can achieve the same relative execution rates of lottery scheduling while significantly reducing the variability in response. Moreover, TFS provides very fast and stable convergence to these resource allocation goals." (Fong page 13 lines 2-3.)

A similar passage is as follows:

> "The 10:1 allocation goal under lottery yields a waiting time variance that

> is 1.13 times larger for class 1 and 743.83 times larger for class 2, in comparison with TFS. These large waiting time variances are caused by the randomness inherent in the lottery scheduling policy." (Fong, sentence bridging pages 16 and 17.)

These passages, and other passages in Fong, state that the non-lottery TFS mechanism taught by Fong provides an improvement over any lottery approach. Given this specific teaching away from a lottery approach, it is not understood how one skilled in the art would be encouraged by Fong to incorporate even one lottery stage into a dispatch system much less the two lottery stages that are claimed by Applicants.

To summarize, Nicastro does not add anything to Fong to teach selection of a level of tasks, followed by selection of a task from the selected level. Moreover, one skilled in the art would not be motivated to combine the two references because they are in completely unrelated fields of art, and because Fong teaches away from incorporating even a one-stage lottery into a resource allocation system.

With the foregoing summary available for discussion purposes, the specific Claim language is next discussed.

Independent Claim 5, as currently amended, includes a two-stage lottery process comprising:

a.) generating a first random number for selecting a class (line 7.)

b.) generating a second random number for selecting a level from a selected class (lines 8-10.)

c.) selecting a task from the selected level (lines 12-13.)

These aspects are not taught or even suggested by Fong. Furthermore, nothing in Nicastro can be construed as teaching use of a two-stage lottery for resource allocation, or selecting a level from a class, then selecting a task from this level.

Finally, any such combination of references is improper. For at least these reasons, Applicants' Claim 5 is allowable over this rejection, which should be withdrawn.

Before considering Applicants' dependent Claims, an additional observation is made regarding Fong that relates to the Examiner's assertions regarding Applicants' dependent Claims. The Fong reference describes three different types of resource allocation mechanisms for comparison purposes:

the Time-Function Scheduling (TFS) approach;

a one-stage lottery mechanism; and

a decay-usage mechanism. (See, for example, Fong page 5, first sentence of last paragraph.)

These three mechanisms are very different, and are discussed throughout Fong for comparison purposes, largely to show the superior nature of the TFS mechanism.

As discussed above, the Examiner cites the Fong discussion of the one-stage lottery approach as teaching the aspects of Applicants' independent Claims. When considering the aspects of Applicants' various dependent Claims, the Examiner does not solely rely on the Fong teachings relative to the one-stage lottery approach, however. Instead, the Examiner cites passages of Fong that relate to the alternative TFS and/or decay-usage approaches. There is no motivation to make this type of combination, as the three different approaches taught by Fong are very different. Presumably, if there were any motivation to make such a combination to obtain some new resource allocation mechanism, Fong herself would have done so.

The Examiner's combining of aspects from two or more very different resource allocation approaches to obtain the aspects taught by Applicants dependent Claims is an impermissible piecing together of Applicants' invention in hindsight, something that has long been held to be improper. For at least this reason, the rejection of Applicants' dependent Claims based on passages related

to the TFS and decay-usage mechanisms of resource allocation in combination with the Fong one-stage lottery approach is improper. This will be discussed further below.

Next, dependent Claims 6 - 10 are considered. These Claims depend either directly or indirectly from Claim 5 and are allowable for all of the reasons discussed above in regards to Claim 5. These Claims are further allowable because they describe additional aspects not taught or suggested by the combination of references cited in the Final Rejection.

For example, Claim 6 describes a level switching routine that handles a failure if a task is not located at a selected level. The Examiner cites page 14 lines 1-19 of Fong for teaching this aspect. The cited passage describes a routine for selecting a job from a class, not a level within a class.

Claim 7 describes the aspect wherein a level is two times more likely to be selected than a next lower level. The Examiner cites page 16 line 23 – page 17 line 8 of Fong as teaching this aspect. The cited passage relates to per-class response times (page 16 line 23). This passage does not appear to have anything to do with levels within a class. Moreover, it may be noted that this cited passage is describing how the lottery mechanism detrimentally increases wait times as compared to TFS approach as follows:

> "The 10:1 allocation goal under lottery yields a waiting *time variance that is 1.13 times larger for class 1 and 743.83 times larger for class 2, in comparison with TFS*. These large waiting time variances are caused by the randomness inherent in the lottery scheduling policy." (Fong, sentence bridging pages 16 and 17, emphasis added.)

Therefore, not only does this passage fail to teach the claimed aspects of Claim 7, it actually *teaches away* from use of the lottery approach of Applicants' Claim 7.

Claim 8 describes the second stage lottery as assigning tasks within a given level to an IP resource for a same amount of time. The Examiner cites

page 7 line 20 – page 8 line 1 of Fong as teaching this aspect. The cited passage is *not* related to any second stage lottery, but instead is describing the time functions of the TFS approach, as is made clear by the two sentences immediately preceding the cited sentence, and as follows:

> "...the system preempts each job that exceeds its quantum, placing it at the end of the run-queue associated with its class to await another quantum of service. The *time-function of each job* is \reset" (sic). (Fong sentence bridging pages 7 and 8, emphasis added.)

Therefore, the cited passage does not teach the claimed aspect of Applicants' second stage lottery. Citing aspects of the TFS approach in combination with a competing and very different lottery approach (which is cited as teaching the aspects of independent Claim 5 from which Claim 8 depends) is an improper hindsight attempt to piece together Applicants' invention.

Claim 9 describes the aspect wherein a bias adjustment routine of the second stage lottery adjusts the amount of time associated with a task based on how long the task last executed on an IP resource. The Examiner cites Fong page 7 line 20 – page 8 line 4 as teaching this aspect. The cited Fong passage is discussing how the TFS approach works, and has nothing to do with a second stage lottery program, as discussed above in regards to Claim 8. Again, this combination of aspects of the TFS approach and the one-stage lottery mechanism of Fong is an improper attempt to piece together Applicants' invention.

The Examiner also cites Fong page 12 lines 12-15 as teaching the aspects of Claim 9. This cited passage is in reference to the UNIX decay-usage scheduling algorithm, which is presented as an alternative to the TFS and lottery mechanisms. (See Fong page 12 lines 5-8.) The passage does not appear related in any way to Applicants' adjustment routine for a lottery approach. The combination of aspects of the decay-usage algorithm with those of the Fong one-stage lottery (cited in regards to Applicants' Claim 5) is improper, as discussed above.

Finally, the Examiner cites Fong page 15 lines 5-15 as teaching the aspects of Claim 9. Again, the cited passage specifically states that is it describing the decay-usage approach, and is *not* related the lottery mechanism. (See Fong page 15 line 1, for example.) For reasons similar to those described above, this rejection is improper.

Claim 10 depends from Claim 9 and relates to adjustment of time when an interrupt occurs. This is said to be taught by the passages of Fong discussed in reference to Claim 9. As previously discussed, these cited passages relate to the TFS and decay usage allocation approaches, and are unrelated to the claimed lottery mechanism of Applicants' Claims 9 and 10.

For at least the additional reasons discussed above, dependent Claims 6-10 are allowable over the prior art cited in the Final Rejection.

Next, independent Claim 12 is considered. This Claim includes all of the aspects discussed above in regards to Claim 5. In particular, this Claim describes a two stage lottery execution process that uses a first lottery process for determining a class, a second process to select a level from the selected class, and then selecting a task from this level. For reasons similar to those discussed above in regards to Claim 5, Claim 12 is allowable over the art cited in the Final Rejection.

Claims 13 – 18 depend from Claim 12 and are allowable over this rejection for reasons similar to those discussed in reference to Claims 5 and 12. These Claims include additional aspects not taught or suggested by Fong, and are therefore allowable over the art cited in the Final Rejection, as follows:

Claims 13 and 14 relate to allowing a user to select a bias for generating a random number, and the number of classes. The Examiner cites page 13 line 29 – page 14 line 1 of Fong as teaching these aspects of the invention. This passage does not appear to relate to, or describe, any user selectable parameters. If this rejection is maintained, more clarification is respectfully requested in regards to this passage as it relates to Claims 13 and 14.

Claim 15 describes handling of tasks within one or more predetermined ("above-the-line") classes that are not handled via the lottery approach, but are given priority before the lottery is conducted. This is described in Applicants' Specification (see page 5, for instance.) The Examiner cites page 13 line 29 – page 14 line 1. This passage relates to using a lottery to select a class, and appears entirely unrelated to having some classes that are not subject to the lottery. If the prior rejection is maintained, more clarification is respectfully requested in regards to this passage as it related to Claim 15.

Claim 17 relates to selecting a low-priority OS task if none of the classes have any tasks as members. The Examiner cites Fong page 10 lines 1-14 as teaching this aspect. The cited passage is describing managing the TFS groups H, T, and L using the TFS approach and is unrelated to a scheduler that implements a two-stage lottery. This combining of aspects of the TFS approach with those of the Fong one-stage lottery mechanism (cited in reference to the base Claim) is improper, as there is no motivation to make this combination.

Independent Claim 19 describes a method that includes all of the aspects described above in regards to Claim 5, including running a first stage of a lottery algorithm to select a class, and running a second stage to select a priority level from which to select a task. Likewise, independent Claim 20 includes aspects similar to those described in Claim 19. For reasons similar to those discussed above in regards to Claim 5, Claims 19 and 20 are allowable over this rejection, which is improper, and should be withdrawn.

Claims 21- 25 depend from Claim 20 and are allowable over this rejection for reasons similar to those discussed above in regards to the independent Claims. Furthermore, these Claims include additional aspects not taught or suggested by the cited references. For example, Claim 21 describes moving a task between priority levels based on an amount of time a task was last assigned to an IP resource. For reasons similar to those discussed above in regards to Claim 9, the cited references do not teach this aspect of the invention.

Claim 22 relates to a specific mechanism for adjusting priority levels and times associated with the tasks based on an amount of time a task used when last executing on an IP resource. The Examiner does not provide any specific citation for this specific mechanism. (See Final Rejection page 8, which discusses the aspects of Claim 21 but not Claim 22.) Nothing in Fong or Nicastro teaches or suggests the specific aspects claimed by this Claim 22, which is allowable over the Final Rejection for this additional reason.

Claim 23, as amended, describes that each task is represented by a task pointer stored on a scheduler queue, and the time associated with a task is assigned prior to the task being stored on the queue. This is said to be taught by Fong page 7 line 20 - page 8 line 4. As discussed above, that passage describes the TFS approach. Since there is no motivation to combine aspects of the TFS resource allocation approach with any teachings of a lottery approach as provided by Fong, this rejection is improper.

Claims 24 and 25 depend from Claim 21, and are allowable for at least the reasons discussed in regards to that independent Claim.

Independent Claim 26 describes a two-stage lottery process, and is allowable over this rejection for at least the reasons described in regards to Claim 5 above.

To summarize, Fong does not in any way teach or suggest Applicants' two-stage lottery mechanism described in each of the independent Claims. In fact, Fong actually teaches away from even a one-stage lottery approach in favor of the TFS approach which is consistently described as superior. Moreover, the rejection of Applicants' dependent Claims relies on the combination of aspects described by Fong in relation to three completely different and contrasting resource allocation mechanisms. There is no motivation to combine aspects of these three completely different approaches, which amounts to impermissibly piecing together Applicants' invention in hindsight. For this additional reason, the rejection of the Claims is improper.

In regards to Nicastro, this reference is in a different area of the art as compared to Fong. One skilled in the art would not be motivated to combine any

Nicastro teachings related to a slot machine with the resource allocation mechanism of Fong. Moreover, even if this combination were made, Nicastro does not add anything to Fong that teaches selecting via a lottery a priority level of tasks, then selecting a task from that priority level. For at least the foregoing reasons, the current rejection is improper, and a Notice of Allowance is respectfully requested for all pending Claims.

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Conclusion

This Request for Continuing Examination (RCE) is accompanied by the submission set for above, which includes an amendment of the Claims. Claims 5-10 and 12-26 remain pending. In the amendment set forth above, Claims 5, 6, 8-10, 12, 15-26 are amended, and the remaining Claims are unchanged. In view of these amendments to the Claims, and the arguments set forth above, it is respectfully submitted that Claims 5-10 and 12-26 are in condition for allowance, and an early Notice of Allowance is respectfully requested. If the Examiner has any questions or concerns regarding this response, a call to the undersigned is appreciated and welcomed.

Respectfully submitted,

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